

Sediment offsets to fund stream restoration for superior environmental outcomes – case study Port of Brisbane

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Key Points

- Over the next 30 years WSUD is estimated to cost \$5.5 billion dollars in SEQ
- Sediment offsets have the potential to provide significant funding for stream bank restoration and superior outcome for the waterways of SEQ

Keywords

Sediment, offsets, Port of Brisbane, WSUD, stream bank restoration

Introduction

The objective of the work was to provide a preliminary investigation into the economic and environmental benefits of providing Offsite Stormwater Quality Solutions for the Port of Brisbane (PBPL).

Off-site stormwater quality solutions provide a mechanism whereby local governments collect payment from developers in lieu of managing stormwater quality on-site. This money is then used to implement regional stormwater solutions (Water by Design 2015).

There is growing interest in off-site solutions in local governments across Queensland and schemes are emerging independent of state-wide guidance.

Our work for PBPL included developing a broad scale MUSIC (Model for Urban Stormwater Improvement Conceptualisation Version 6) model and applying an overarching bioretention treatment to the future developable area; calculation of sediment load captured and allowable discharge load of TSS and the provision of alternative off-site stormwater management abatements options and costs.

Modelling

The initial step required digitising the land use map supplied by PBPL (Figure 1). The site was then delineated into catchments and industry standard event mean concentrations (EMC) were applied to each landuse with the exception of the coal stockpile landuse which we applied an EMC from previous work by O2. The bioretention basins were sized to achieve the required PBPL and Queensland Water Quality Guidelines (2013) load reductions for each catchment. Four modelling scenarios for Fisherman's Island were undertaken including:

1. Unmitigated TSS loads from developed land utilising default MUSIC pollutant export parameters and other pollutant export parameters values as previously determined by O2 (i.e. coal stockpiles).
2. Mitigated TSS loads captured from developed land assuming best management practices have been implemented utilising default MUSIC pollutant export parameters and other pollutant export parameters values as previously determined by O2 (i.e. coal stockpiles).
3. Unmitigated TSS loads from future undeveloped land utilising default MUSIC pollutant export parameters.

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4. Mitigated TSS load from future undeveloped land utilising default MUSIC pollutant export parameters.

Landuse

A hardcopy land use map was provided by PBPL. This map was then digitised using the maps land use categories to allow input into MUSIC

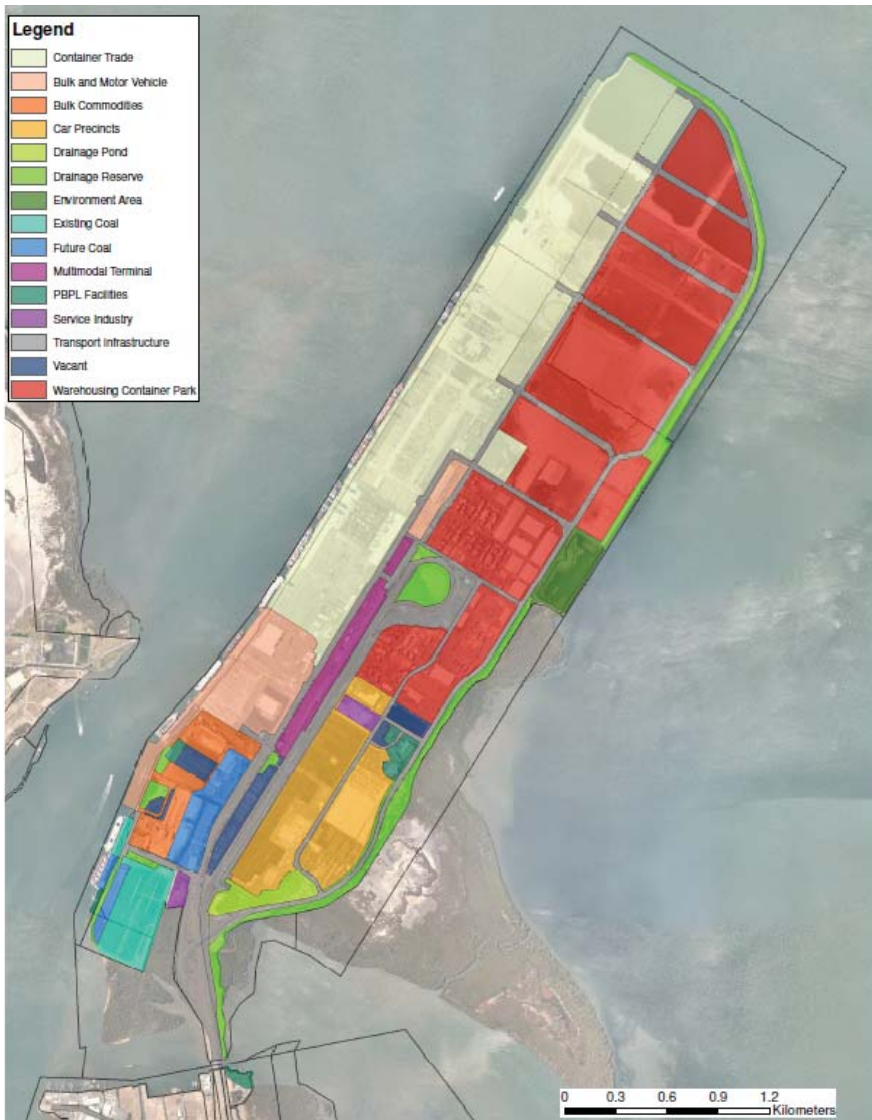


Figure 1. Site Landuse Categorisation

Modelling Results and Associated Costs

Summary results from the 4 modelled scenarios are displayed below in Table 1.

Table 1. Summary of modelling results

No	Scenario	Load (t/yr)	Total Loads (25 years) tonnes	Total bioretention filter area (m ²)	Bioretention as % of catchment	Approx. life cycle cost of bioretention (@\$890/m ²)*
1	Unmitigated TSS loads from developed land	2,820	70,500	-	-	-
2	Mitigated TSS loads captured from developed land assuming best management practices have been implemented	2,389	59,725	100,879	1.36	\$89.8 million
3	Unmitigated TSS loads from future undeveloped land	412	10,300	-	-	-
4	Mitigated TSS load from future undeveloped land	335	8,372	34,908	1.2	\$31 million

* Water by Design (2014) – Construction \$300m², Design - 5% of construction costs, Land costs \$300m², Annual maintenance \$5/m²/yr, Annual renewal \$6/m²/yr,

Alternative offset solution - stream bank restoration

There are a number of applicable solutions which may apply as offsite stormwater quality solutions. To our knowledge the only recent successful example in Queensland was the Beaudesert STP Nitrogen pilot project (O’Mara et al, 2014). The project involved an investment of \$1 million by the Queensland Urban Utilities to repair 500 metres of eroded riparian corridors near the Beaudesert Sewage Treatment Plant (STP) in the Logan River catchment. The offset project allowed Beaudesert STP to continue at its current capacity in the short term without undertaking an \$8 million upgrade, saving \$7 million dollars. The project works is forecasted to prevent approximately 11,200 tonnes of sediment from entering the Logan River each year due to natural erosion.

SEQ catchments project managed the pilot study, contributing to its conceptualisation, planning and delivery. River engineering modelling, design and construction was undertaken by consultants. We have recently spoken to SEQ Catchments regarding costs of the project and have determined that it is between \$250 - \$500/tonne depending on land costs.

Cost of current stormwater quality solutions compared to a contributions toward offsets

The cost saving to PBPL by making an offset contribution in lieu of WSUD can be demonstrated by comparing costs of 3 PBPL recent WSUD projects (which included bio-swales, Bio Pods and a Stormwater 360 StormFilter) compared to a potential contribution of \$65,880/ha (Water by Design, 2010) which is equal to the average lifecycle cost for industrial development.

Table 2. Savings using recommended contributions

Project	Life cycle Costs/ha	Total project lifecycle costs	Potential contribution	Savings to PBPL or client	Scale of savings
1	\$706,252	\$1,560,817	\$145,595	\$1,415,222*	10.7
2	\$442,752	\$889,931	\$132,419	\$757,512	6.7
3	\$82,667	\$1,240,000	\$988,200	\$251,800	1.3

* Another benefit to the client is they get access to land that they are paying rent for that would have been used for stormwater treatment.



Figure 2. Example of a Bioretention basin at the Port of Brisbane

Conclusions

There are 300 ha of undeveloped land on Fisherman's Island. Potential costs were analysed by modelling the required sediment to be mitigated and applying a cost per tonne of sediment and using industry and local project figures of cost per hectare. The sites broad scale MUSIC modelling indicates that PBPL will need to mitigate 4,855 tonnes (needs to be captured by a treatment) of sediment for future development to achieve the required load based reduction targets. The cost of using offsite stormwater solutions would be \$4.9 million (including a 2:1 offset factor) compared to the bioretention cost of \$22.3million. Local project figures for treatments ranged from \$82,667- \$706,252/ha with a total cost between \$25 million and \$212 million. Depending on the treatment selected offsite stormwater quality solutions have the potential to save on average between 4 – 43 times the costs of onsite treatments.

If PBPL adopt a contribution amount of \$65,880/ha (average lifecycle cost for industrial development) the resultant savings from current practices will be 7 - 12.5 times. The total contribution to offsite stormwater quality solutions would be \$19.8 million (present value) over 25 years. Adopting \$500/tonne (per comm. SEQ Catchments) and a 2:1 offset factor (equaling 16,744 tonnes over 25 years) results in a total cost of approximately \$8.4 million to offset TSS. The additional contributions collected could be directed towards offsetting developed areas of the PBPL that are not achieving current industry standards either due to poor or outdated design or increasing environmental equivalence ratio/factor.

In summary using current site WSUD practices for the 300ha of future developable land will cost between \$25 and \$212 million compared to \$8.4 million by offsetting the impacts utilizing stream bank restoration. This could be accomplished by the Port of Brisbane (PBPL) taking a contribution from its clients equal to \$65,880/ha (average lifecycle cost for industrial development). This contribution amount would also allow a higher environmental equivalence ratio/factor if deemed appropriate for projects in the upper catchment.

PBPL has funded a \$500,000 pilot program to implement a trial offsite stormwater treatment pilot in Laidley Creek in the Upper Brisbane catchment. The project has repaired approximately 500 metres of eroded riparian corridors and funding studies and research including geochemical analyses and radionuclide fingerprinting of sediment.

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